February 1974 Division of Range Research

U S D A FOREST SERVICE
RESEARCH NOTE RM-254

FOREST SERVICE
U. S. DEPARTMENT OF AGRICULTURE

ROCKY MOUNTAIN FOREST AND RANGE EXPERIMENT STATION

Growth Characteristics of Bearberry in the Black Hills

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Growth of bearberry varied widely between plants and between sites. Most annual growth (66 percent) occurred during June when moisture and temperature conditions were apparently optimum. Annual growth can readily be recognized by the presence of nodes and by color changes.

Oxford: 156.2:181.61. Keywords: Wildlife habitat management, *Arctostaphylos uva-ursi*.

Bearberry (Arctostaphylos uva-ursi (L.) Spreng.), often referred to as bearberry manzanita or kinnikinnick, has been recognized as one of the most important food items in the diet of deer in the Black Hills, particularly during fall and winter[2] (Schneeweis et al. 1972, Schenck et al. 1972).

Studies to determine production and nutritive composition of this prostrate, evergreen shrub require familiarity with its growth habits and morphological characteristics. Current annual growth is difficult to recognize on some evergreen shrubs, a problem anticipated with bearberry because of the color variation among plants and because some shoots had several nodes whereas others apparently had none. Because of this wide variability, a study was initiated in 1971 to (1) gain some insight into the growth patterns, and (2) to determine which morphological characteristics could be used to aid in the recognition of annual growth.

The study was conducted in the Black Hills Experimental Forest approximately 7 miles northeast of Rochford, South Dakota.

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Methods

Two areas, each with an overstory of ponderosa pine (Pinus ponderosa) and a well-developed understory of bearberry, were selected for study. Sampling began in early May 1971. Four 100-foot line transects were randomly located within each site. Each transect was divided into 12 equal segments (8.3 feet). One bearberry shoot was randomly selected within each segment. The tip of each shoot was marked by pushing a 9-inch piece of 12-gage wire into the ground beside the shoot. The wire had a small hook on the end formed to fit firmly over the shoot 3 to 6 cm from the tip. A small numbered aluminum disc was also attached to the wire to identify the shoot. The distance from the wire hook to the tip of each shoot was measured and recorded. The plants were measured once during the first 5 days of each month from May through October in 1971 and 1972.

Basal area and density of the overstory were determined for each site from the 100-foot transects. The trees in a 20-foot-wide belt, 10 feet on either side of the line, were counted and d.b.h. measured. Densities were expressed as number of trees per acre, and d.b.h. was converted to square feet of basal area per acre.

The percentage canopy cover and ground cover of bearberry were obtained by the line intercept method (Canfield 1941) on the transects. Percentage canopy cover of the overstory was determined by shade intercept.

At the end of the second year, all live plants were clipped at the point of tagging, and annual growth was remeasured in the laboratory. Growth characteristics for each plant were noted by known growth patterns. Two groups of plants were randomly selected from this collection for annual growth measurements by five different observers, who were first given a brief description of annual growth characteristics of bearberry. Observer measurements were individually compared with the known annual growth derived from the monthly measurements.

Results and Discussion

Growth Characteristics

Growth characteristics of bearberry varied widely, particularly between individual plants and between sites. Mean growth was greatest both years on Site 1, however (table 1).

Table 1.--Mean monthly growth(cm) of bearberry on two Black Hills sites, 1971-72

Month	Site I		Site II		Total
	1971	1972	1971	1972	
May	0.3	0.7	0.3	0.8	2.1
June	10.3	9.2	5.3	1.9	26.7
July	1.2	3.4	.4	1.0	6.0
August	.4	1.7	.3	.5	2.9
September	.5	.8	.8	.5	2.6
Total	12.7	15.8	7.1	4.7	40.3

We were not able to draw any conclusions about why growth varied so widely, but we were able to determine some consistent differences between plants. First, there were color differences between fast and relatively slower growing plants. The stems of slower growing plants were pale to milky green, whereas the faster growing stems tended to be red to dark maroon. Plants that were pink had intermediate growth. Out of a sample of 79 plants, 73 were readily classified as green, pink, or red. Annual growth averaged 4.1, 7.8, and 19.5 cm, respectively, for these color groups.

Statistical tests also showed highly significant differences between months and between sites; no differences were noted between years.

Differences in mean monthly growth were attributed to June growth. The June increment averaged 78.8 percent of the total annual growth on Site 1 over both years, and 49.0 percent on Site 2. Over both sites, 66.3 percent of the annual increment was added during June.

Dissimilar physical and biological attributes between the two sites could account for the difference in growth between sites. Site 1 was located on a moderate (10 percent) slope with a southeast exposure. Ponderosa pine overstory was relatively open, with approximately 390 stems per acre and a basal area of 120 square feet per acre. The percentage canopy cover of the overstory and the percent of ground covered by bearberry were 42 and 43 percent, respectively. Site 2, on a very gentle (3 percent) northwest-facing slope, had about 525 ponderosa pine stems per acre with a basal area of 148 square feet. The percentage canopy cover of the overstory was 55, while 37 percent of the ground surface was covered by bearberry.

Cumulative growth on Site 1 was greater in 1972 than in 1971, whereas plants on Site 2 grew more in 1971 (table 1). Growing season precipitation was substantially higher in 1972 (table 2). It is difficult to explain this response. The increased precipitation and slightly lower air temperatures coupled with the north exposure and higher canopy cover of the overstory on Site 2 may have resulted in microclimatic temperatures less than optimum for bearberry growth.

Table 2.--Monthly precipitation (inches) from base weather station, Black Hills Experimental Forest, during growing season, 1971-72

Month	1971	1972
May	5.93	4.24
June	1.87	9.09
July	1.31	3.69
August	.50	2.63
September	2.97	.71
Total, growing season	12.60	20.36

Recognition of Annual Growth

At the end of the second growing season, all plants were clipped at the point of tagging and annual growth characteristics were closely examined in the laboratory. Annual growth could be recognized by the presence of a node and by relative color changes along the stem. Nodes are quite distinctive and completely encircle the stem, appearing as a series of reddish or brownish scales (fig. 1). There was

Figure 1.—Bearberry nodes—a series of overlapping scales that circle the stem. (Scale division = 1 mm)

some initial confusion in recognizing the point of annual growth, caused by the variability in growth and color between plants and by the fact that bearberry will occasionally branch above the node.

Color changes will also assist in differentiating between old and new growth. New growth on stems tends to be lighter in color and, on green stems, a pale, pinkish cast may also be evident.

There were no significant differences between the annual growth measurements by each of the observers and the known annual growth. All observers could readily recognize annual growth of bearberry after only a few basic instructions.

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